

WHAT IS CLAIMED IS:

1. A zoom lens apparatus, comprising:

a first optical lens group having a negative focal
5 length arranged at a first position closest to a subject;

a second optical lens group having a positive focal
length arranged at a second position second closest to the
subject;

an aperture diaphragm which is disposed to a subject
10 side of the second optical lens group closer to the subject
in a manner such that the aperture diaphragm is movable
integrally with the second optical lens group; and

a third optical lens group having a positive focal
length arranged at a third position third closest to the
15 subject,

wherein the first optical lens group, the second
optical lens group, and the third optical lens group move in
such a way that a distance between the first optical lens
group and the second optical lens group is gradually
20 decreased and a distance between the second optical lens
group and the third optical lens group is gradually increased
when a scaling of the zoom lens system is changed from a
short focal length edge to a long focal length edge,

wherein the second optical lens group comprises a
25 three-group and four-lens structure which comprises:

a positive lens arranged at a first sub-position

closest to the subject in the second optical lens group and such that a greater-curvature surface of the positive lens faces the subject;

5 a negative meniscus lens arranged at a second sub-position second closest to the subject in the second optical lens group and such that a concave of the negative meniscus lens faces the subject;

a positive meniscus lens conjoined with the negative meniscus lens and arranged at a third sub-position
10 third closest to the subject in the second optical lens group; and

a positive lens arranged at a fourth sub-position fourth closest to the subject in the second optical lens group,

15 wherein the zoom lens system satisfies an inequality condition $0.15 < (N_{22} - N_{23}) < 0.40$, wherein N_{22} is a refractive index of the negative meniscus lens of the second optical lens group and N_{23} is a refractive index of the positive meniscus lens of the second optical lens group conjoined with
20 the negative meniscus lens.

2. The zoom lens system according to Claim 1, wherein the zoom lens system satisfies an inequality condition $25 < (v_{22} - v_{23}) < 50$, wherein v_{22} is an Abbe number of the
25 negative meniscus lens in the second optical lens group and v_{22} is an Abbe number of the positive meniscus lens conjoined

with the negative meniscus lens in the second optical lens group.

3. The zoom lens system according to Claim 1,
5 wherein the zoom lens system satisfies an inequality condition $1.40 < ((1/r_{21F}) + (1/r_{22F}) + (1/r_{22R})) < 2.20$, wherein r_{21F} is a radius of curvature of a subject-side surface of the positive lens arranged at the first sub-position in the second optical lens group, r_{22F} is a radius of curvature of a
10 subject-side surface of the negative meniscus lens arranged at the second sub-position in the second optical lens group, r_{22R} is a radius of curvature of a conjoined surface of the negative meniscus lens arranged at the second sub-position and the positive lens arranged at the third sub-position in
15 the second optical lens group, and Y' is an image height.

4. The zoom lens system according to Claim 1,
wherein the zoom lens system satisfies an inequality condition $1.40 < (L_{PN}/L_2) < 0.70$, wherein L_{PN} is a distance
20 between a summit of the subject-side surface of the positive lens arranged at the first sub-position and a summit of the conjoined surface of the negative meniscus lens arranged at the second sub-position and the positive lens arranged at the third sub-position in the second optical lens group, and L_2
25 is a thickness of the second optical lens group in a direction of a light axis of the second optical lens group.

5. The zoom lens system according to Claim 1,
wherein the conjoined surface of the negative meniscus lens
arranged at the second sub-position and the positive lens
5 arranged at the third sub-position has a radius of curvature
which is greatest among lens surfaces included in the second
optical lens group.

6. The zoom lens system according to Claim 1,
10 wherein the subject-side surface of the positive lens
arranged at the first sub-position in the second optical lens
group and an image-side surface of the positive lens arranged
at the fourth sub-position are aspherical.

15 7. A zoom lens apparatus, comprising:
a first optical lens group having a negative focal
length arranged at a first position closest to a subject;
a second optical lens group having a positive focal
length arranged at a second position second closest to the
20 subject;
an aperture diaphragm which is disposed to a subject
side of the second optical lens group closer to the subject
in a manner such that the aperture diaphragm is movable
integrally with the second optical lens group; and
25 a third optical lens group having a positive focal
length arranged at a third position third closest to the

subject,

wherein the first optical lens group, the second optical lens group, and the third optical lens group move in such a way that a distance between the first optical lens group and the second optical lens group is gradually decreased and a distance between the second optical lens group and the third optical lens group is gradually increased when a scaling of the zoom lens system is changed from a short focal length edge to a long focal length edge,

wherein the second optical lens group comprises a three-group and four-lens structure which comprises:

a first positive lens arranged at a first sub-position closest to the subject in the second optical lens group and such that a greater-curvature surface of the positive lens faces the subject;

a negative meniscus lens arranged at a second sub-position second closest to the subject in the second optical lens group and such that a concave of the negative meniscus lens faces the subject;

a positive meniscus lens conjoined with the negative meniscus lens and arranged at a third sub-position third closest to the subject in the second optical lens group; and

a second positive lens arranged at a fourth sub-position fourth closest to the subject in the second optical lens group,

wherein the zoom lens system satisfies an inequality condition $1.40 < ((1/r_{21F}) + (1/r_{22F}) + (1/r_{22R})) < 2.20$, wherein r_{21F} is a radius of curvature of a subject-side surface of the first positive lens arranged at the first sub-position in the second optical lens group, r_{22F} is a radius of curvature of a subject-side surface of the negative meniscus lens arranged at the second sub-position in the second optical lens group, r_{22R} is a radius of curvature of a conjoined surface of the negative meniscus lens arranged at the second sub-position and the meniscus positive lens arranged at the third sub-position in the second optical lens group, and Y' is an image height.

8. A zoom lens apparatus, comprising:
- 15 a first optical lens group having a negative focal length arranged at a first position closest to a subject;
 - a second optical lens group having a positive focal length arranged at a second position second closest to the subject;
 - 20 an aperture diaphragm which is disposed to a subject side of the second optical lens group closer to the subject in a manner such that the aperture diaphragm is movable integrally with the second optical lens group; and
 - a third optical lens group having a positive focal length arranged at a third position third closest to the subject,

wherein the first optical lens group, the second optical lens group, and the third optical lens group move in such a way that a distance between the first optical lens group and the second optical lens group is gradually
5 decreased and a distance between the second optical lens group and the third optical lens group is gradually increased when a scaling of the zoom lens system is changed from a short focal length edge to a long focal length edge,

wherein the second optical lens group comprises a
10 three-group and four-lens structure which comprises:

a first positive lens arranged at a first sub-position closest to the subject in the second optical lens group and such that a greater-curvature surface of the first positive lens faces the subject;

15 a negative meniscus lens arranged at a second sub-position second closest to the subject in the second optical lens group and such that a concave of the negative meniscus lens faces the subject;

a positive meniscus lens conjoined with the
20 negative meniscus lens and arranged at a third sub-position third closest to the subject in the second optical lens group; and

a second positive lens arranged at a fourth sub-position fourth closest to the subject in the second optical
25 lens group,

wherein the zoom lens system satisfies an inequality

condition $1.40 < (L_{PN}/L_2) < 0.70$, wherein L_{PN} is a distance between a summit of the subject-side surface of the first positive lens arranged at the first sub-position and a summit of the conjoined surface of the negative meniscus lens arranged at the second sub-position and the meniscus positive lens arranged at the third sub-position in the second optical lens group, and L_2 is a thickness of the second optical lens group in a direction of a light axis of the second optical lens group.

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9. A zoom lens apparatus, comprising:

a first optical lens group having a negative focal length arranged at a first position closest to a subject;

15 a second optical lens group having a positive focal length arranged at a second position second closest to the subject;

an aperture diaphragm which is disposed to a subject side of the second optical lens group closer to the subject in a manner such that the aperture diaphragm is movable integrally with the second optical lens group; and

20 a third optical lens group having a positive focal length arranged at a third position third closest to the subject,

wherein the first optical lens group, the second optical lens group, and the third optical lens group move in such a way that a distance between the first optical lens

group and the second optical lens group is gradually decreased and a distance between the second optical lens group and the third optical lens group is gradually increased when a scaling of the zoom lens system is changed from a
5 short focal length edge to a long focal length edge,

wherein the second optical lens group comprises a three-group and four-lens structure which comprises:

a first positive lens arranged at a first sub-position closest to the subject in the second optical lens group and such that a greater-curvature surface of the first
10 positive lens faces the subject;

a negative meniscus lens arranged at a second sub-position second closest to the subject in the second optical lens group and such that a concave of the negative
15 meniscus lens faces the subject;

a positive meniscus lens conjoined with the negative meniscus lens and arranged at a third sub-position third closest to the subject in the second optical lens group; and

20 a second positive lens arranged at a fourth sub-position fourth closest to the subject in the second optical lens group,

wherein the conjoined surface of the negative meniscus lens arranged at the second sub-position and the positive
25 lens arranged at the third sub-position has a radius of curvature which is greatest among lens surfaces included in

the second optical lens group.

10. A digital camera, comprising:

a zoom lens system which comprises:

5 a first optical lens group having a negative focal length arranged at a first position closest to a subject;

a second optical lens group having a positive focal length arranged at a second position second closest to
10 the subject;

an aperture diaphragm which is disposed to a subject side of the second optical lens group closer to the subject in a manner such that the aperture diaphragm is movable integrally with the second optical lens group; and

15 a third optical lens group having a positive focal length arranged at a third position third closest to the subject,

wherein the first optical lens group, the second optical lens group, and the third optical lens group move in
20 such a way that a distance between the first optical lens group and the second optical lens group is gradually decreased and a distance between the second optical lens group and the third optical lens group is gradually increased when a scaling of the zoom lens system is changed from a
25 short focal length edge to a long focal length edge,

wherein the second optical lens group comprises a

three-group and four-lens structure which comprises:

a positive lens arranged at a first sub-position closest to the subject in the second optical lens group and such that a greater-curvature surface of the positive lens faces the subject;

a negative meniscus lens arranged at a second sub-position second closest to the subject in the second optical lens group and such that a concave of the negative meniscus lens faces the subject;

a positive meniscus lens conjoined with the negative meniscus lens and arranged at a third sub-position third closest to the subject in the second optical lens group; and

a positive lens arranged at a fourth sub-position fourth closest to the subject in the second optical lens group,

wherein the zoom lens system satisfies an inequality condition $0.15 < (N_{22} - N_{23}) < 0.40$, wherein N_{22} is a refractive index of the negative meniscus lens of the second optical lens group and N_{23} is a refractive index of the positive meniscus lens of the second optical lens group conjoined with the negative meniscus lens.

11. A personal digital assistance apparatus, comprising:

a zoom lens system which comprises:

a first optical lens group having a negative focal length arranged at a first position closest to a subject;

a second optical lens group having a positive focal length arranged at a second position second closest to the subject;

an aperture diaphragm which is disposed to a subject side of the second optical lens group closer to the subject in a manner such that the aperture diaphragm is movable integrally with the second optical lens group; and

a third optical lens group having a positive focal length arranged at a third position third closest to the subject,

wherein the first optical lens group, the second optical lens group, and the third optical lens group move in such a way that a distance between the first optical lens group and the second optical lens group is gradually decreased and a distance between the second optical lens group and the third optical lens group is gradually increased when a scaling of the zoom lens system is changed from a short focal length edge to a long focal length edge,

wherein the second optical lens group comprises a three-group and four-lens structure which comprises:

a positive lens arranged at a first sub-position closest to the subject in the second optical lens group and such that a greater-curvature surface of the

positive lens faces the subject;

a negative meniscus lens arranged at a second sub-position second closest to the subject in the second optical lens group and such that a concave of the negative meniscus lens faces the subject;

a positive meniscus lens conjoined with the negative meniscus lens and arranged at a third sub-position third closest to the subject in the second optical lens group; and

a positive lens arranged at a fourth sub-position fourth closest to the subject in the second optical lens group,

wherein the zoom lens system satisfies an inequality condition $0.15 < (N_{22} - N_{23}) < 0.40$, wherein N_{22} is a refractive index of the negative meniscus lens of the second optical lens group and N_{23} is a refractive index of the positive meniscus lens of the second optical lens group conjoined with the negative meniscus lens.

12. A zoom lens apparatus, comprising:

a first lens group having a negative focal length and arranged at a first position from a subject side;

a second lens group having a positive focal length and arranged at a second position from the subject side;

an aperture diaphragm arranged in front of a subject side surface of the second lens group and configured to move

together with the second lens group; and

a third lens group having a positive focal length and arranged at a third position from the subject side,

wherein at least the first and second lens groups move
5 at a time the zoom lens apparatus changes a scaling from a short focal length edge to a long focal length edge such that a distance between the first and second lens group is decreased and that a distance between the second and third lens group is increased,

10 wherein the first lens group comprises:

a first negative meniscus lens having a concave lens surface facing an image plane and arranged at a first in-group position from the subject side;

a double-convex lens arranged at a second in-group
15 position from the subject side; and

a double-concave lens conjoined with the double-concave lens and arranged at a third in-group position from the subject side.

20 13. The zoom lens apparatus according to Claim 12, wherein the first lens group further comprises a second negative meniscus lens arranged between the first negative meniscus lens and the double-concave lens.

25 14. The zoom lens apparatus according to Claim 13, wherein the zoom lens apparatus satisfies an inequality

condition $0.20 < (D_4/L_1) < 0.40$, wherein D_4 is a distance on a light axis between an image side surface of the second negative meniscus lens in the first lens group and a subject side surface of the double-convex lens and L_1 is a distance
5 on a light axis between a subject side surface of the first negative meniscus lens and an image side surface of the double-concave lens in the first lens group.

15. The zoom lens apparatus according to Claim 13,
10 wherein the zoom lens apparatus satisfies an inequality condition $1.60 < (N_{14}) < 1.90$, wherein D_{14} is a refractive index of the double-concave lens of the first lens group.

16. The zoom lens apparatus according to Claim 15,
15 wherein the zoom lens apparatus satisfies inequality conditions $-0.20 < (N_{13} - N_{14}) < 0.10$ and $5 < (v_{14} - v_{13}) < 25$, wherein N_{13} is a refractive index of the double-convex lens of the first lens group, N_{14} is a refractive index of the double-concave lens of the first lens group, v_{13} is an Abbe number of the
20 double-convex lens of the first lens group, and v_{14} is an Abbe number of the double-concave lens of the first lens group.

17. The zoom lens apparatus according to Claim 13,
25 wherein an image side surface of the second negative meniscus lens in the first lens group is aspheric.

18. The zoom lens apparatus according to Claim 13,
wherein the second lens group comprises:

5 a first positive lens having a great-curvature surface
facing the subject side and arranged at a first in-group
position from the subject side;

a negative meniscus lens having a concave surface
facing the image side and arranged at a second in-group
position from the subject side;

10 a positive meniscus lens conjoined with the negative
meniscus lens and arranged at a third in-group position from
the subject side; and

a second positive lens arranged at a fourth in-group
position from the subject side.

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19. The zoom lens apparatus according to Claim 18,
wherein the zoom lens apparatus satisfies inequality
conditions $-0.15 < (N_{22} - N_{23}) < 0.40$ and $25 < (v_{23} - v_{22}) < 50$, wherein N_{22}
is a refractive index of the negative meniscus lens of the
20 second lens group, N_{23} is a refractive index of the positive
meniscus lens conjoined with the negative meniscus lens in
the second lens group, v_{22} is an Abbe number of the negative
meniscus lens of the second lens group, and v_{23} is an Abbe
number of the positive meniscus lens conjoined with the
25 negative meniscus in the first lens group.

20. The zoom lens apparatus according to Claim 18,
wherein the zoom lens apparatus satisfies an inequality
condition $1.40 < \{ (1/r_{21F}) + (1/r_{22F}) + (1/r_{22R}) \} * Y' < 2.20$, wherein r_{21F}
is a curvature radius of a subject side surface of the first
5 positive lens in the second lens group, r_{22F} is a curvature
radius of a subject side surface of the negative meniscus
lens in the second lens group, r_{22R} is a curvature radius of a
conjoined surface of the negative meniscus lens and the
positive meniscus lens in the second lens group, and Y' is an
10 image height.

21. The zoom lens apparatus according to Claim 18,
wherein the zoom lens apparatus satisfies an inequality
condition $0.40 < (L_{PN}/L_2) < 0.70$, wherein L_{PN} is a distance on a
15 light axis between the a subject side surface of the first
positive lens and a conjoined surface of the negative
meniscus lens and the positive meniscus lens in the second
lens group, and L_2 is a distance on a light axis between the
subject side surface of the first positive lens and an image
20 side surface of the second positive lens in the second lens
group.

22. The zoom lens apparatus according to Claim 18,
wherein a curvature of a conjoined surface of the negative
25 meniscus lens and the positive meniscus lens in the second
lens group is a greatest curvature in the second lens group.

23. The zoom lens apparatus according to Claim 18,
wherein a subject side surface of the first positive lens and
an image side surface of the second positive lens are
5 aspheric.

24. The zoom lens apparatus according to Claim 12,
wherein the second lens group comprises:
at least one negative lens; and
10 at least three positive lenses.

25. The zoom lens apparatus according to Claim 24,
wherein the first lens group further comprises a second
negative meniscus lens arranged between the first negative
15 meniscus lens and the double-concave lens.

26. The zoom lens apparatus according to Claim 24,
wherein the at-least-one negative lens is a negative meniscus
lens having a concave surface facing the image side and
20 arranged at a second in-group position from the subject side,
and the at-least-one positive lenses are a first positive
lens having a great-curvature surface facing the subject side
and arranged at a first in-group position from the subject
side, a positive meniscus lens conjoined with the negative
25 meniscus lens arranged at a third in-group position from the
subject side, and a second positive lens arranged at a fourth

in-group position from the subject side.

27. A digital camera comprising:

a zoom lens apparatus which comprises:

5 a first lens group having a negative focal length and arranged at a first position from a subject side;

a second lens group having a positive focal length and arranged at a second position from the subject side;

10 an aperture diaphragm arranged in front of a subject side surface of the second lens group and configured to move together with the second lens group; and

a third lens group having a positive focal length and arranged at a third position from the subject side,

15 wherein at least the first and second lens groups move at a time the zoom lens apparatus changes a scaling from a short focal length edge to a long focal length edge such that a distance between the first and second lens group is decreased and that a distance between the second and third lens group is increased,

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wherein the first lens group comprises:

a first negative meniscus lens having a concave lens surface facing an image plane and arranged at a first in-group position from the subject side;

25 a double-convex lens arranged at a second in-group position from the subject side; and

a double-concave lens conjoined with the double-concave lens and arranged at a third in-group position from the subject side.

5 28. A personal digital assistance apparatus,
comprising:

 a zoom lens apparatus which comprises:

 a first lens group having a negative focal length
and arranged at a first position from a subject side;

10 a second lens group having a positive focal
length and arranged at a second position from the subject
side;

 an aperture diaphragm arranged in front of a
subject side surface of the second lens group and configured
15 to move together with the second lens group; and

 a third lens group having a positive focal length
and arranged at a third position from the subject side,

 wherein at least the first and second lens groups move
at a time the zoom lens apparatus changes a scaling from a
20 short focal length edge to a long focal length edge such that
a distance between the first and second lens group is
decreased and that a distance between the second and third
lens group is increased,

 wherein the first lens group comprises:

25 a first negative meniscus lens having a concave
lens surface facing an image plane and arranged at a first

in-group position from the subject side;

a double-convex lens arranged at a second in-group position from the subject side; and

a double-concave lens conjoined with the double-
5 concave lens and arranged at a third in-group position from
the subject side..